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REPRESENTATIVES OF GENUS *AEGILOPS* AS A SOURCE OF PATHOGENS RESISTANCE

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Abstract

The main purpose of breeding programs is to obtain high yields of common winter wheat (Triticum aestivum L.). Development of new lines and varieties resistant to economically important diseases related to the yield, is associated with proper selection of the initial breeding material. Most of the phylogenetic species closest to bread wheat, such as representatives of the genus Aegilops, possess valuable genes for biotic stress resistance. To establish appropriate accessions which could be involved in the hybridization and breeding programs of bread wheat, 32 accessions of the genus Aegilops (10 of Aegilops cylindrica, 12 of Aegilops tauschii, 6 of Aegilops ventricosa, one of the species Aegilops ovata, Aegilops neglecta and Aegilops speltoides) were observed, as regards their resistance to the pathogens of powdery mildew (Erysiphe graminis), brown rust (Puccinia recondita) and septoria leaf blight (Septoria tritici). The observation was conducted under field conditions in the ear formation stage. All studied accessions were completely resistant to the pathogen of septoria leaf blight (Septoria tritici). All accessions of Aegilops cylindrica, 3 of Aegilops tauschii and 2 of Aegilops ventricosa were susceptible to powdery mildew. Accessions of Aegilops cylindrica and also 8 accessions of Aegilops tauschii and 3 accessions of Aegilops ventricosa are susceptible to brown rust. Accessions of Aegilops ovata, Aegilops neglecta and Aegilops speltoides are completely resistant to the three pathogens. With the highest complex resistance are accessions AE192, AE1609 and AE20 compared to other accessions of Aegilops tauschii and Aegilops ventricosa. The combination of high complex resistance to diseases, and a large phylogenetic proximity with genus Triticum, makes Aegilops tauschii and Aegilops ventricosa valuable sources of genes for resistance which could be successfully transferred into different wheat species.

Keywords: *Aegilops sp., resistance, Triticum aestivum.*

INTRODUCTION

Wheat is one of the major food crops satisfying feeding of the world population. Top priority to its production is to increase the quality and quantity of the yield. This is achieved through a variety of breeding and cultivation methods. At the present stage of development of agriculture increasing role are the selection methods due to their extensive nature. Creation of new wheat varieties which are characterized by higher quality properties such as resistance to pathogens (powdery mildew, brown rust, septoria leaf blight), tolerance to abiotic stress (drought, logging, salinity, metal toxicity, frost), high protein and lysine content. Achieving of these results, combined with an increase in quantitative characteristics (yields per unit area, hectolitre weight) is a challenge due to ever increasing demand for higher quality wheat. In relation to this, an important stage in the breeding process is qualitative selection of starting breeding material, which take part in breeding programs of different wheat species. The combination of all important parameters, makes necessary collection and comprehensive studies of many samples in order to achieve optimum results in the breeding process and highly productive bread wheat varieties to be created.

Wide hybridization is an essential tool of the classical breeding, which aims to transfer valuable properties of wild relatives into cultural plants. In relation to this, valuable results have been achieved in a large part of the crops into the family *Poaceae*, and in sunflower, beans, tomatoes, cotton, tobacco. Wide hybrids are applicable in improving the quality of bread wheat as the main wild relatives used in crosses are the representatives of the genus *Aegilops* (Stoyanov, 2013).

Aegilops genus belongs to the family *Poaceae* and incorporate 23 representatives. Van Slageren (1994) describes 22 representatives of the genera with 27 varieties in 5 sections and differentiate *Aegilops mutika*, in a separate genus - *Amblyopyrum*. Most representatives possess diploid number of chromosomes, but occurs tetraploid and hexaploid. In phylogenetic terms the genus is closest to the genus *Triticum*, which determines the high degree of crossability, viability and significant fertility of the most hybrids and amphidiploids between species of the genera *Aegilops* and *Triticum*. This is due to the identical subgenomes involved in the genomes of plants into both genera – *Triticum aestivum* (AABBDD), *Aegilops tauschii* (DD), *Aegilops cylindrica* (CCDD), *Aegilops ventricosa* (NNDD) (Spetsov et al., 2008; Spetsov et al., 2009).

Species of the genus *Aegilops*, possess valuable properties, such as resistance to the pathogens of powdery mildew, brown rust and septoria leaf blight. Hybrids where the wild species is involved exhibit similar pathogens resistance. These qualities and with the easy obtaining of hybrid offspring between species of *Aegilops* and *Triticum*, makes it possible the resistance to be relatively easily transferred into bread wheat. Successfully are transferred genes for resistance to powdery mildew in bread wheat *Triticum aestivum* from *Aegilops speltoides* (Jia et al., 1995), *Aegilops tauschii* (Miranda et al., 2007), *Aegilops umbellulata* (Zhu et al., 2006), *Aegilops variabilis* (Stoilova & Spetsov, 2005), *Aegilops ovata* (Spetsov, 2004), *Aegilops kotschyi* (Spetsov, 2004). Resistance to the pathogen show amphidiploids bred in DAI-General Toshevo in the period 1950-1990 - *Ae. tauschii* x *Tr. boeoticum*, *Ae. tauschii* x *H. villosa*, *Tr. dicoccon* x *Ae. tauschii*, *Tr. timopheevi* x *Ae. tauschii*, *Tr. durum* x *Ae. speltoides*, *Tr. aestivum* x *Ae. speltoides*, *Ae. tauschii* x *Tr. paleocolchicum* x *Elymus giganteus* x *Tr. dicoccon*, *Tr. aestivum* x *Ae. variabilis*, *Tr. aestivum* x *Ae. kotschyi*, *Tr. aestivum* x *Ae. ovata*, *Tr. aestivum* x *Ae. columnaris* (Spetsov and Savov, 1992). Genes for resistance to brown rust is transferred to bread wheat from species *Aegilops triuncialis* (Kuraparthy et al., 2011), *Aegilops tauschii* (Lalkova et al., 2003), *Aegilops umbelullata* (Chhunea et al., 2007), *Aegilops speltoides* (Cherukuri et al., 2005). Hybrid plants of *Triticum aestivum* x *Aegilops cylindrica* exhibit good results in terms of brown rust resistance (Stoyanov et al., 2012). Appropriate species for the transfer of resistance genes by the method of wide hybridization are species *Aegilops triuncialis*, *Aegilops ovata*, *Aegilops biuncialis* (Ivanova, 2012). Resistance to yellow rust pathogen, possess wide hybrids of *Triticum aestivum* with *Aegilops sharonensis* (Marais et al., 2010). Resistance to black rust is transferred to bread wheat from species *Aegilops searsii* (Liu et al., 2011), *Aegilops speltoides* (Mago et al., 2009), *Aegilops cylindrica*, *Aegilops tauschii* (Babayants et al., 2010). Potential sources of resistance to septorai leaf blight are *Aegilops speltoides, Aegilops tauschii* (Van Ginkel & Rajaram, 1999) and *Aegilops umbelullata* (Maksimov et al., 2006).

Resistance to powdery mildew, brown rust and septoria leaf blight in representatives of the genus *Aegilops*, could be either monogenic or polygenic. For this reason, the different species and accessions exhibit different resistance to the certain pathogen. Furthermore, the presence of similar genomes of wild species and bread wheat may be a prerequisite for the evolution of similar susceptibility to pathogens, depending on the direction of transfer and exchange of genes - from wild species to the cultural (mostly this is an artificial and is rarely associated with evolutionary processes) or from cultural species of the wild (often in natural wide hybridization (Ayala and Kiger, 1987; Stoyanov, 2013). Thus, depending on the phylogenetic development of the species, accessions are separated by a different level of resistance to a certain pathogen.

The purpose of this report is to identify the different levels of resistance of representatives of the genus *Aegilops* to the pathogens of powdery mildew, brown rust and septoria leaf blight, and to assess the suitability of different accessions to be included as starting breeding material in breeding programs of bread wheat.

MATERIALS AND METHODS

32 accessions, representatives of the genus *Aegilops* were examined, presented in Table 1

(Appendix 1). 15 seeds of each sample are sown in rows 1m in length, spaced at 30 cm and 5 cm in the rows. Sowing was carried out on 11.11.2012, in Stozher, Dobrich region.
To determine the infectious type of the three pathogens ten point scale, aligned on the respective scales of susceptibility for each of the pathogens was used: for powdery mildew - scale of Mains and Dietz (in Dochev et al., 2009); for brown rust scale of Cereal Rust Laboratory, Minnesota, USA (in Dochev et al., 2009); for septoria leaf blight scale of Rosielle (Eyal et al., 1978). The equivalent scale and other scales are listed in Table 2 (Appendix 2).
The attacking rate (AR) expressed as % infected leaf area for each accession was determined by the formula of McKinney (McKinney, 1923) and distribution rate (DR) is defined as the ratio of infected to uninfected plants of each accession, expressed in % (Nakov et al., 2007).
The evaluation has been conducted under field conditions in 2013 in phase milky maturity of the accessions, where natural races of the pathogens are presented. For proper identification of pathogens and reporting of their appearance, standard varieties for susceptibility are used: to powdery mildew (*Erysiphe graminis*) - Sadovska ranozreyka, brown rust (*Puccinia recondita*) - Michigan Amber, septoria leaf blight (*Septoria tritici*) - Enola.
Assessment of the suitability of the accessions as a starting material is made on the basis of a 3-point scale identical for the three studied pathogens and resistant, intermediate resistant and susceptible accessions are defined (Table 2 (Appendix 2) [* And **]).

RESULTS AND DISCUSSIONS

In Table 3 (Appendix 3) are presented the results of the infectious type of the analyzed accessions. According to the applicable 10-point aligned scale clearly could be distinguished the variation in susceptibility to pathogens, as well as to the various species and between accessions within a species. As regards the infectious type largest variation was observed for the powdery mildew (124%), lower for brown rust (86%) and none for the septoria leaf blight.
This demonstrates the strong polymorphism of species of the genus *Aegilops*, due to their diverse geographical life habitat and the different populations of pathogens which were present in the phylogenetic development of each species. Certain species and accessions (AE20, AE1609, AE192, A101, AOS, ANS) are completely resistant to the observed pathogens, which suggests the presence of vertical monogenic resistance. Many researchers identify specific genes carrying resistance to pathogens of powdery mildew and brown rust. Such data reports Assefa and Fehrmann (2000), Huang and Gill (2001), Raupp et al. (2011), Singh et al. (2004), Naik et al. (1998), Kuraparthy et al. (2007), Schneider et al. (2008), Feuillet et al. (1995), Valkoun et al. (1984). Only in septoria leaf blight, in the majority of cases, polygenic horizontal resistance was reported, especially in low concentration of the pathogenic inoculum, which are due to different plant mechanisms - thick habitus, physiologically dying of the leaves, and early maturity (Eyal et al., 1978).
As regards the attacking rate (Table 4) there is a similarity with the data for the infectious type. In this case some correlation between infection type and attacking rate is observed (99.2% for EG and 98.00% for PR). The wide variation in this indicator (126% for EG and 92% for PR) is due to the presence of vertical resistance in some of the accessions (AE192, AE20, AE1496, AE101, AOS, ANS). This is significant, as the attack on powdery mildew and brown rust is in a broad range. The differences observed presuppose, that individual pathotype of pathogens to be search in accessions with very low expression of susceptibility.
The distribution rate (Table 4; Appendix 4) is indicative of the variation in susceptibility to a pathogen of a plant-specific level. Spread of the pathogen with a relatively high degree of attack exhibits genetic polymorphism in some of the accessions, which proves certain heterozygosity, especially in *Aegilops tauschii* and *Aegilops ventricosa*. In accessions of *Aegilops cylindrica* in this case, it can be assumed homozygous-based lack of resistance due to 100% distribution rate, while *Aegilops ovata*, *Aegilops neglecta* and *Aegilops speltoides*, assumes homozygous vertical

resistance to all three tested pathogen. Ivanova (2012), reported differences in the attacking rate and distribution in different accessions of *Aegilops*, depending on the species and accessions, confirming the strong polymorphic nature of wild species.

With the highest infectious type, attacking rate and distribution rate the species *Aegilops cylindrica* is distinguished. In the studied accessions, the pathogens of powdery mildew and brown rust are highly prevalent in all plants, which determine the lack of monogenic resistance. Variation in the attacking rate is observed depending on the climatic conditions for the accession ACS (Stoyanov, personal communication). Stoaynov (2013), Stoyanov et al. (2012), indicate that the accession ACC46, which originates from accession ACS is completely resistant to powdery mildew and brown rust, as well as hybrid plants obtained with its participation. This is indicative of differentiation within species. Plamenov (2003) listed the species as highly polymorphic in its morphology. Since the morphological polymorphism resulted from certain physiological abnormalities in the phylogeny of the species, it could be assumed that the studied accessions were polymorphic in relation to their own pathogenic susceptibility i.e. it is observed race specificity within a species, at the of individual plant-level. At the same time, the studied accessions were completely resistant to septoria leaf blight. Resistance is probably species-specific because in the country only races attacking wheat and triticale are presented as Rodeva (2004) and Vasileva et al. (2006) reported.

Studied accessions of *Aegilops tauschii*, exhibit a strong variation in the attack of powdery mildew and brown rust. Unlike *Aegilops cylindrica*, in this species no cross susceptibility to both the pathogen is observed, which determines the presence of vertical resistance to particular races represented in the area. Since *Aegilops tauschii* is not typical for the area where the study was conducted, it is assumed that attacked accessions are infected with races specific to *Aegilops cylindrica* and species of the genus *Triticum*. This determines race-specific resistance of the species. In some of the accessions (AE26, AE213, AE205, AE32, AE1496), the observed intraspecific variation in the attacking rate and infection type is indicative of the certain polymorphism of resistance, which suggesting resistance to low-virulent races, and moderate susceptibility to the strong-virulent. Since powdery mildew and brown mildew races are classic-type races, in this case different pathotypes are assumed, which is indicative of the variability at pathogen-level. It is also observed complete resistance to septoria leaf blight. Similar is the attack of the three pathogen species in accessions of *Aegilops ventricosa*. In both species has been reported the presence of specific genes determining vertical resistance to three pathogens. Such genes reported Assefa and Fehrmann (2000), Huang and Gill (2001), Raupp et al. (2011), Huang et al. (2003), Bartos et al. (2005), Hussien et al. (1997), Gill et al. (1986), Huang and Gill (1999).

Aegilops ovata, *Aegilops neglecta* and *Aegilops speltoides* feature complete resistance of the nature-presented races of the pathogen of powdery mildew, brown rust and septoria leaf blight. This assumes a vertical resistance. Many authors have reported successfully transferred resistance genes of these species in bread wheat (Damania and Pecetti, 1990; Marais et al., 2010; Spetsov, 2004; Spetsov et al., 2006; Zaharieva et al., 2004; Van Ginkel and Rajaram, 1999).

CONCLUSIONS

Based on the presented results, the following conclusions could be made:

1. Accessions of *Aegilops cylindrica* and some accessions of *Aegilops tauschii* and *Aegilops ventricosa* are highly susceptible to the pathogens of powdery mildew and brown rust.
2. Accessions of *Aegilops tauschii* and *Aegilops ventricosa* are determined with a wide variation in their attacking rate, distribution rate and infectious type, which is indicative of their intraspecific polymorphism.
3. All studied accessions were completely resistant to the pathogen at the septoria leaf blight, which is due to the species-specific resistance.
4. *Aegilops ovata*, *Aegilops neglecta* and *Aegilops speltoides* exhibit complete resistance of the nature presented races of the

pathogen of powdery mildew, brown rust and septoria leaf blight.

5. With best resistance to pathogens of brown rust and powdery mildew are characterized accessions AE192, AE1609 and AE20 and they could be successfully involved into the breeding programs of bread wheat and in the obtaining of synthetic hexaploid lines.

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APPENDIX 1

Table 1. Accessions per species, origin and date of sowing

No	Species	Accession	Date of sowing	Plants number	Origin
1	*Aegilops cylindrica*	ACS	15.11.2012	15	wild (Stozher)
2	*Aegilops cylindrica*	AE1512	15.11.2012	15	IPK-G
3	*Aegilops cylindrica*	AE573	15.11.2012	15	IPK-G
4	*Aegilops cylindrica*	AE540	15.11.2012	15	IPK-G
5	*Aegilops cylindrica*	AE790	15.11.2012	15	IPK-G
6	*Aegilops cylindrica*	AE746	15.11.2012	15	IPK-G
7	*Aegilops cylindrica*	AE712	15.11.2012	15	IPK-G
8	*Aegilops cylindrica*	AE1025	15.11.2012	15	IPK-G
9	*Aegilops cylindrica*	AE848	15.11.2012	15	IPK-G
10	*Aegilops cylindrica*	AE1035	15.11.2012	15	IPK-G
11	*Aegilops cylindrica*	ACD	15.11.2012	15	wild (Debrene)
12	*Aegilops tauschii*	AE3	13.11.2012	15	IPK-G
13	*Aegilops tauschii*	AE26	13.11.2012	15	IPK-G
14	*Aegilops tauschii*	AE213	13.11.2012	15	IPK-G
15	*Aegilops tauschii*	AE205	13.11.2012	15	IPK-G
16	*Aegilops tauschii*	AE192	13.11.2012	15	IPK-G
17	*Aegilops tauschii*	AE1609	13.11.2012	15	IPK-G
18	*Aegilops tauschii*	AE190	13.11.2012	15	IPK-G
19	*Aegilops tauschii*	AE183	13.11.2012	15	IPK-G
20	*Aegilops tauschii*	AE141	13.11.2012	15	IPK-G
21	*Aegilops tauschii*	AE67	13.11.2012	15	IPK-G
22	*Aegilops tauschii*	AE32	13.11.2012	15	IPK-G
23	*Aegilops tauschii*	ATS1	13.11.2012	15	DAI-GT
24	*Aegilops ventricosa*	AE617	13.11.2012	15	IPK-G
25	*Aegilops ventricosa*	AE1613	13.11.2012	15	IPK-G
26	*Aegilops ventricosa*	AE1496	13.11.2012	15	IPK-G
27	*Aegilops ventricosa*	AE730	13.11.2012	15	IPK-G
28	*Aegilops ventricosa*	AE28	13.11.2012	15	IPK-G
29	*Aegilops ventricosa*	AE20	13.11.2012	15	IPK-G
30	*Aegilops ovata*	AOS	15.11.2012	15	DAI-GT
31	*Aegilops neglecta*	ANS	15.11.2012	15	DAI-GT
32	*Aegilops speltoides*	AE101	05.03.2013	15	IPK-G
33	*Triticum aestivum*	SR	11.11.2012	15	DAI-GT
34	*Triticum aestivum*	MA	11.11.2012	15	DAI-GT
35	*Triticum aestivum*	EN	11.11.2012	15	M-AGRO
36					

IPK-G – Leibniz Institute of Plant Genetics and Crop Plant Research-Genebank, Germany; DAI-GT – Dobrudzha Agricultural Institute-General Toshevo, Bulgaria; M-AGRO – M-AGRO Limited Liability Company-Stozher, Bulgaria;

APPENDIX 2

Table 2. Equivalent 10-grade assessment pathogens scale

No	Equivalent 10-grade assessment scale*		Mains and Dietz scale		Coreal Rust Laboratory, Minnesota scale		Rosielle's *S.tritici* scale	
	Code**	Characteristics						
1	R(0)	Immune (Imm)	0	Immune (Imm)	0	Very resistant (VR)	0	Immune (Imm)
2	R(1)	Higly resistant (HR)	0	Higly resistant (HR)	1	Very resistant (VR)	1	Higly resistant (HR)
3	R(2)	Very resistant (VR)	1	Resistant (R)	2	Resistant (R)	2	Resistant (R)
4	M(3)	Resistant (R)	1	Resistant (R)	3	Resistant (R)	2	Resistant (R)
5	M(4)	Moderate resistant (MR)	2	Intemediate (I)	4	Moderate resistant (MR)	3	Intemediate (I)
6	M(5)	Moderate (M)	2	Intemediate (I)	5	Moderate resistant (MR)	3	Intemediate (I)
7	M(6)	Moderate susceptible (MS)	3	Susceptible (S)	6	Moderate susceptible (MS)	4	Susceptible (S)
8	S(7)	Susceptible (S)	3	Susceptible (S)	7	Moderate susceptible (MS)	4	Susceptible (S)
9	S(8)	Very susceptible (VS)	4	Very susceptible (VS)	8	Susceptible (S)	5	Very susceptible (VS)
10	S(9)	Higly susceptible (HS)	4	Very susceptible (VS)	9	Susceptible (S)	5	Very susceptible (VS)

*Note: The equivalent 10-grade assessment scale is used to determine the infectious type. For starting breeding material assessment three level scale is used - R (resistant), M (medium-resistant), S (susceptible) (Stoyanov, 2013)

**Note: The code of the scale is composed of a letter (R, M or S) which indicate the breeding evaluation, and number (0-9) which indicate the infectious type.

APPENDIX 3

Table 3. Assessment of *Aegilops* accessions for powdery mildew, leaf rust and septoria leaf blight by 10-grade scale via infectious type (IT)

No	Species	Accession	EG	PR	ST
1	*Aegilops cylindrica*	ACS	S(8)	S(9)	R(0)
2	*Aegilops cylindrica*	AE1512	S(8)	S(8)	R(0)
3	*Aegilops cylindrica*	AE573	S(8)	S(7)	R(0)
4	*Aegilops cylindrica*	AE540	S(7)	S(8)	R(0)
5	*Aegilops cylindrica*	AE790	S(9)	S(8)	R(0)
6	*Aegilops cylindrica*	AE746	S(8)	S(7)	R(0)
7	*Aegilops cylindrica*	AE712	S(9)	S(8)	R(0)
8	*Aegilops cylindrica*	AE1025	S(8)	S(8)	R(0)
9	*Aegilops cylindrica*	AE848	S(8)	S(7)	R(0)
10	*Aegilops cylindrica*	AE1035	S(9)	S(7)	R(0)
11	*Aegilops cylindrica*	ACD	S(8)	S(9)	R(0)
12	*Aegilops tauschii*	AE3	R(1)	S(8)	R(0)
13	*Aegilops tauschii*	AE26	R(0)	R(1)	R(0)
14	*Aegilops tauschii*	AE213	R(0)	M(4)	R(0)
15	*Aegilops tauschii*	AE205	R(0)	M(5)	R(0)
16	*Aegilops tauschii*	AE192	R(0)	R(0)	R(0)
17	*Aegilops tauschii*	AE1609	R(0)	R(0)	R(0)
18	*Aegilops tauschii*	AE190	R(1)	R(0)	R(0)
19	*Aegilops tauschii*	AE183	M(3)	R(0)	R(0)
20	*Aegilops tauschii*	AE141	R(0)	S(8)	R(0)
21	*Aegilops tauschii*	AE67	R(0)	S(8)	R(0)
22	*Aegilops tauschii*	AE32	R(0)	R(1)	R(0)
23	*Aegilops tauschii*	ATS1	R(0)	R(1)	R(0)
24	*Aegilops ventricosa*	AE617	R(0)	R(0)	R(0)
25	*Aegilops ventricosa*	AE1613	R(0)	S(7)	R(0)
26	*Aegilops ventricosa*	AE1496	R(0)	M(3)	R(0)
27	*Aegilops ventricosa*	AE730	M(3)	M(3)	R(0)
28	*Aegilops ventricosa*	AE28	R(1)	R(0)	R(0)
29	*Aegilops ventricosa*	AE20	R(0)	R(0)	R(0)
30	*Aegilops ovata*	AOS	R(0)	R(0)	R(0)
31	*Aegilops neglecta*	ANS	R(0)	R(0)	R(0)
32	*Aegilops speltoides*	AE101	R(0)	R(0)	R(0)
33	*Triticum aestivum*	SR	S(9)	M(4)	M(4)
34	*Triticum aestivum*	MA	M(5)	S(9)	M(4)
35	*Triticum aestivum*	EN	M(4)	M(4)	S(8)
AVERAGE			3.09	4.21	0
STANDART DEVIATION			3.82	3.64	0
VARIATION COEFFICIENT (%)			124	86	-

EG – powdery mildew (*Erysiphe graminis*); PR – leaf rust (*Puccinia recondita*); ST – septoria leaf blight (*Septoria tritici*); SR – Sadovska ranozreika; MA – Michigan amber; EN – Enola.

APPENDIX 4

Table 4. Assessment of *Aegilops* accessions for powdery mildew, leaf rust and septoria leaf blight via attacking rate (AR) and distribution rate (DR)

No	Species	Accession	EG		PR		ST	
			AR, %	DR, %	AR, %	DR, %	AR, %	DR, %
1	*Aegilops cylindrica*	ACS	93.50	100.00	96.25	100.00	0.00	0.00
2	*Aegilops cylindrica*	AE1512	95.75	100.00	94.00	100.00	0.00	0.00
3	*Aegilops cylindrica*	AE573	97.50	100.00	92.00	100.00	0.00	0.00
4	*Aegilops cylindrica*	AE540	99.33	100.00	95.50	100.00	0.00	0.00
5	*Aegilops cylindrica*	AE790	99.50	100.00	94.50	100.00	0.00	0.00
6	*Aegilops cylindrica*	AE746	91.00	100.00	88.75	100.00	0.00	0.00
7	*Aegilops cylindrica*	AE712	99.50	100.00	95.75	100.00	0.00	0.00
8	*Aegilops cylindrica*	AE1025	95.00	100.00	96.00	100.00	0.00	0.00
9	*Aegilops cylindrica*	AE848	94.00	100.00	92.75	100.00	0.00	0.00
10	*Aegilops cylindrica*	AE1035	99.50	100.00	92.25	100.00	0.00	0.00
11	*Aegilops cylindrica*	ACD	85.50	100.00	97.50	100.00	0.00	0.00
12	*Aegilops tauschii*	AE3	15.00	46.67	92.00	100.00	0.00	0.00
13	*Aegilops tauschii*	AE26	0.00	0.00	23.00	40.00	0.00	0.00
14	*Aegilops tauschii*	AE213	0.00	0.00	28.00	53.33	0.00	0.00
15	*Aegilops tauschii*	AE205	0.00	0.00	39.00	46.67	0.00	0.00
16	*Aegilops tauschii*	AE192	0.00	0.00	0.00	0.00	0.00	0.00
17	*Aegilops tauschii*	AE1609	0.00	0.00	0.00	0.00	0.00	0.00
18	*Aegilops tauschii*	AE190	10.00	46.67	0.00	0.00	0.00	0.00
19	*Aegilops tauschii*	AE183	22.50	73.33	0.00	0.00	0.00	0.00
20	*Aegilops tauschii*	AE141	0.00	0.00	95.75	100.00	0.00	0.00
21	*Aegilops tauschii*	AE67	0.00	0.00	93.00	100.00	0.00	0.00
22	*Aegilops tauschii*	AE32	0.00	0.00	11.00	46.67	0.00	0.00
23	*Aegilops tauschii*	ATS1	0.00	0.00	5.00	46.67	0.00	0.00
24	*Aegilops ventricosa*	AE617	0.00	0.00	0.00	0.00	0.00	0.00
25	*Aegilops ventricosa*	AE1613	0.00	0.00	78.75	100.00	0.00	0.00
26	*Aegilops ventricosa*	AE1496	0.00	0.00	13.50	46.67	0.00	0.00
27	*Aegilops ventricosa*	AE730	17.50	66.67	10.00	40.00	0.00	0.00
28	*Aegilops ventricosa*	AE28	12.00	46.67	0.00	0.00	0.00	0.00
29	*Aegilops ventricosa*	AE20	0.00	0.00	0.00	0.00	0.00	0.00
30	*Aegilops ovata*	AOS	0.00	0.00	0.00	0.00	0.00	0.00
31	*Aegilops neglecta*	ANS	0.00	0.00	0.00	0.00	0.00	0.00
32	*Aegilops speltoides*	AE101	0.00	0.00	0.00	0.00	0.00	0.00
33	*Triticum aestivum*	SR	99.00	100.00	8.00	40.00	7.00	20.00
34	*Triticum aestivum*	MA	32.50	46.67	99.25	100.00	9.00	26.67
35	*Triticum aestivum*	EN	20.50	40.00	4.00	40.00	62.50	93.33
AVERAGE			35.22	43.12	47.63	56.87	0	0
STANDART DEVIATION			44.72	46.43	44.22	44.44	0	0
VARIATION COEFFICIENT (%)			126	107	92	78	-	-

EG – powdery mildew (*Erysiphe graminis*); PR – leaf rust (*Puccinia recondita*); ST – septoria leaf blight (*Septoria tritici*); SR – Sadovska ranozreika; MA – Michigan amber; EN – Enola.